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Study of the Patterns of Use of e-Resources in Aerospace Engineering by the Indian Aerospace Scientists and Engineers of Selected Aerospace Organizations in Bangalore: Part - I - Use of e-Journals

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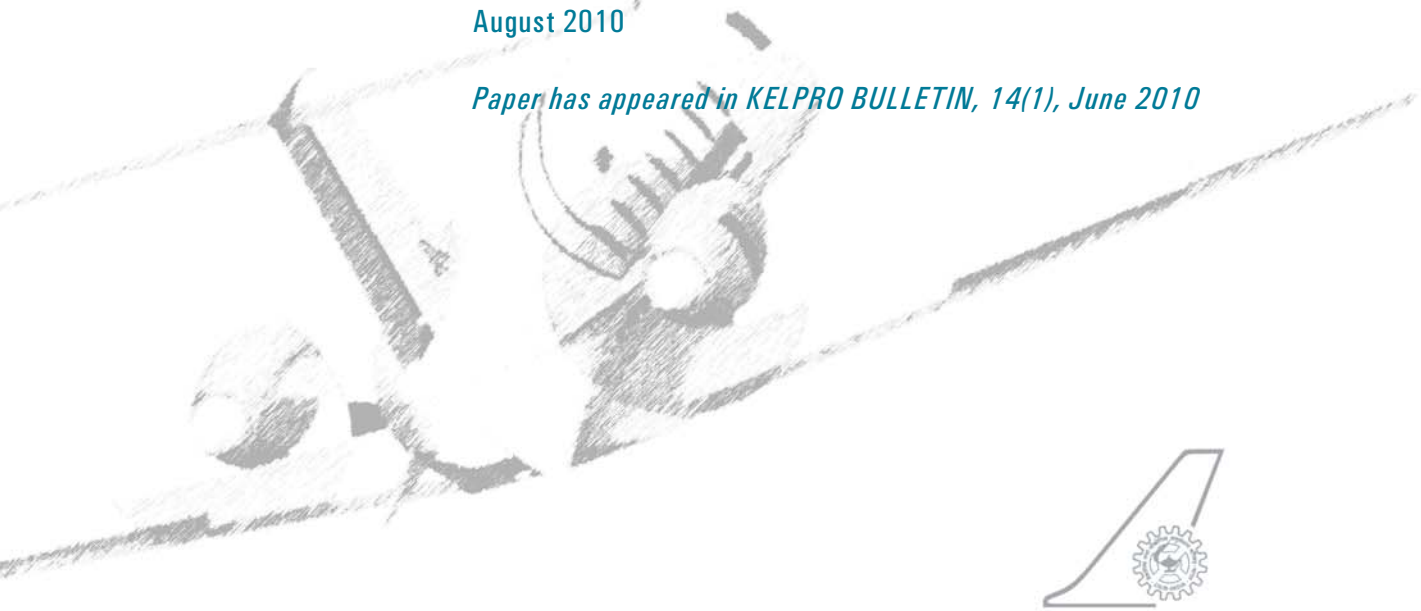

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Study of the Patterns of Use of e-Resources in Aerospace Engineering by the Indian Aerospace Scientists and Engineers of Selected Aerospace Organizations in Bangalore: Part – I – Use of e-Journals

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Abstract: : Aerospace engineers and scientists greatly depend upon the network and Internet technologies for accessing electronic information resources in the form of e-journals related to aerospace engineering right at their desktops. A survey study was undertaken amongst 16 prestigious aerospace organizations in Bangalore, which is the sampling boundary. Out of the 650 questionnaires distributed, a total number of 612 were received back and finally 583 selected which were found suitable for the study. The analysis is based on the responses for the questionnaire received from the aerospace scientists and engineers belonging to the selected aerospace organizations. The responses from the participants towards the frequency of use of aerospace engineering e-journals were graded on a scale of 4 to 0, a score of 4 indicating 'Daily' access. The major findings in this paper are: (a) *The summary of total mean scores obtained with regard to usage of aerospace engineering e-journals represents the following pattern*: The highest mean score of 1.25(CV=110.44) is obtained for the journal 'Aerospace Science and Technology'. This is followed by a mean score of 1.20(CV=111.16) which is represented for 'Progress in Aerospace Sciences'. The third highest mean score of 1.12(CCV=114.14) is reflected for 'Journal of Aerospace Engineering'. This is followed by a mean score of 1.08(CV=121.57) which is represented for 'IEEE Transactions on Electronics and Aerospace Systems'. 'Web of Science' follows up with the next highest mean score of 1.01(CV=132.41). 'Online Journals: Aerospace' gets the next highest mean score of 0.95(CV=129.23). This is followed by the 'Journal of Turbo and Jet Engines' which gets the next highest mean score of 0.90(CV=137.69). 'The Journal of Failure Analysis and Prevention (ASM International)' comes up with the next highest mean score of 0.78(CV=151.37). This is followed by a mean score of 0.73(CV=150.54) which is represented by 'European Space Bulletin – ESA'. 'Informatics –Gate' represents itself with a mean score of 0.72(CV=160.02). Finally, the lowest mean score of 0.67(CV=166.17) is reflected for 'International Journal of Satellite Communications and Networking', (b) *Analysis of Variance (ANOVA)* was applied for testing the significant difference among the 16 mean scores attained from the scientists and engineers of the aerospace organizations for 'Frequency of Access and Usage of Aerospace Engineering e-Journals'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., 'Web of Science', 'Informatics J-Gate', European Space Bulletin – ESA', 'International Journal of Satellite Communications and Networking', 'International Journal of Turbo and Jet Engines', 'Journal of Aerospace Engineering – ASCE', 'Progress in Aerospace Sciences', Aerospace Science and Technology', 'IEEE transactions on Electronic and Aerospace Systems', 'Online Journals: Aerospace' and 'Journal of Failure Analysis and Prevention – ASM International'

Key Words: Aerospace engineering, e-Journals, The Internet, Electronic Scholarly Communication, Information Dissemination, Gutenberg's Printing Press, Aerospace and Defense Resources (AERADE), Electronic Information Resources.

1. Introduction

It is absolutely clear that traditional print journals, even those available electronically are slowly changing. There is a paradigm shift in their usage and they are moving towards electronic formats. Many studies have revealed that the electronic versions of papers are being read as often as the printed journal versions. The growth rates in usage of electronic information resources are sufficiently high and if this trend

continues for a few more years, a time may come soon when the print versions will get 'totally eclipsed'. The coming of the World Wide Web has propelled this vigorous growth of the electronic forms of communication which simply do not fit into the traditional publishing format. With the coming of the age of the electronic journals, it has totally altered the way scholarly communication is disseminated throughout the world. Many interesting studies conducted over time on faculties, scientists and researchers have shown that journal and journal articles continued to be valued resources. According to Tenopir and King [1], use of electronic journals saw a big jump in the last half of the 1990s and is continuing to escalate. On an average, one-half to nearly 100 percent of the scientists in a field use electronic journals at least part of the time. Scientists have revealed that journal articles are highly important to their work, more than any other information sources. Also, scientists are willing to pay a high price in their time as they spend many hours reading scientific literature.

2. A Brief History of Scholarly Electronic Communication and the Coming of e-Journals

Tenopir and King [2], opine that until the late seventeenth century, communication between scholars depended heavily upon personal contact and by attending meetings arranged by the learned societies (e.g. The Royal Society). As the membership grew and as many could not attend the meetings, so the proceedings, usually a record of the last meeting became a place to publish papers that had not been at all presented at the meetings, these eventually evolved into scholarly journals. The first peer-reviewed journals were the Philosophical Transactions of the Royal Society and Journal de Scavans both published in 1665. The coming of the 19th century saw an explosion in the number of journals produced, caused by increased specialization and diversification of academic research and also the means of producing mass publishing (using cheap wood pulp based paper). Elsevier Scientific Publishing began publishing engineering journals way back as 1884. After the World War-II, Robert Maxwell set up the Pergamon Press which pioneered the move towards mass commercial publishing. By 1960, commercial publishers had occupied a major part of the market. Although, the first prototype e-journal was in 1976, the booming time for the electronic journals was during the period 1990 to 1995, mainly dominated by non-profit making groups who exploited the technology for their own sake.

If Gutenberg's invention of the printing press in the 15th century was a great leap towards information dissemination, then invention of the World Wide Web is equally a great leap towards electronic scholarly communication, Harnad [3], rightly has opined that 'the arrival of the electronic communication is the fourth revolution in the means of production of knowledge' after spoken language, written language and the printing press.

Electronic Journals or e-Journals are full text or abstracts of journal articles available electronically on the Internet or CD-ROMs [4]. Another definition says, Electronic Journals are nothing but, "Electronic versions of printed journals that can be viewed online via any PC connected to the Internet" [5].

Valauskas [6], defines an "electronic journal" as a digital periodical dedicated to publishing on the Internet, articles, essays, and analyses that have been read and commented upon initially by a select group of editors and reviewers, to meet a certain standard of excellence for a given discipline addressed by the journal itself". Medium distinguishes between electronic and print journals. Very nature of electronic journals implies ample opportunities for experimentation: fonts, format, layout, design.

3. Aerospace and Defense Resources (AERADE) Pioneering Initiatives in Promoting the Use of Aerospace Electronic Information Resources

The Aerospace Information Management – UK (AIM-UK) project – found compelling evidence of 'under-utilization' of 'electronic information resources' by the aerospace scientists and engineers. It recommended a number of initiatives to raise awareness and improve access to useful electronic information resources, and to reduce the threat of 'information overload'. In particular, there was a call to establish an Internet gateway and portal to the aerospace and defense community that would act as a 'jumping-off-point' for effective exploration and retrieval of information on the World Wide Web. AERADE, launched in November, 1999 was specifically designed to meet this need. AERADE is a pioneering initiative by the Cranfield University to enable aerospace and defense experts to find relevant information on the Internet. Today, the reports archive is a historical collection of over 10,000 significant technical papers and reports by the Aeronautical Research Council (ARC) and the National Advisory Committee for Aeronautics (NACA), Hanley; Harrington and Blagden [7].

4. National Aerospace Laboratories and Allied Aerospace Establishments in Bangalore

The city of Bangalore, Karnataka is considered the 'Aerospace Hub' of the country with many key aerospace organizations which have already been established several years ago like (a) The National Aerospace Laboratories (NAL), (b) The Hindustan Aeronautics Limited (HAL), (c)The Aeronautical Development Establishment (ADE), (d) The Indian Space Research Organization (ISRO), (e) The Aeronautical Development Agency (ADA). It also comprises many key Indian Air Force establishments like (a) Air Force Systems and Testing Establishment (ASTE), (b) Air Force Technical College (AFTC) and the (c) Institute of Aviation Medicine (IAM). In a nutshell, many of these organizations come under the broad umbrella of (i) Council of Scientific and Industrial Research (CSIR), (ii) Defense Research and Development Organizations (DRDO), (iii) The Indian Air Force (IAF), (iv) Educational Institutions like IISc and (v) Major public sector undertakings. All of them in their own way have significantly contributed to a large number of Indian aerospace programmes.

The National Aerospace Laboratories is India's premier civil aviation R&D aerospace research organization in the country. Its main mandate is the 'Develop ment of aerospace technologies with a strong science content and with a view to their practical application to the design and construction of flight vehicles'. NAL is also required 'to use its aerospace technology base for general industrial applications'. 'Technology' would be its core engine-driver for the future. NAL is also best known for its main sophisticated aerospace R&D testing facilities which are not only unique for this country but also comparable to similar facilities elsewhere in the world. The present research survey was an NAL initiative jointly with the Department of Library and Information Science, University of Mysore.

Today, every NAL scientist has access to online electronic scholarly information right at his desktop. This has been possible with the help of the National Institute of Science Communication and Information Resources (NISCAIR) through its CSIR e-conglomerate. Access has been provided to almost 6,000 e-journals by tying up with 23 international publishers. This facility enables any CSIR scientist to access, browse, search and download 'full-text' journal articles from any computer system connected to the campus wide network. The present proposed work would study the patterns of 'full-text' downloads of scholarly electronic journals also.

5. Locating Useful Aerospace Engineering e-Resources on the Internet

The World Wide Web provides a plethora of information for scientists and engineers working in various disciplines. Aerospace engineers and scientists largely refer to core aerospace engineering e-journals from reputed publishers, off-line and on-line aerospace databases, aerospace gateways, aerospace wikis, aerospace patent services, aerospace portals, e-journals from professional associations, open-access e-journals, aerospace standards, aerospace indexing, abstracting and citation services, aerospace

conference proceedings, aerospace blogs and aerospace theses and dissertations and aerospace monographs on the Internet.

It is observed that in many of the reputed Universities in the US, the concerned subject librarians create their own e-resources web-sites, which contain their photographs and contact e-mail address. These web-sites form one section of the main web site of the concerned university. Innumerable hyperlinks are provided to various e-resources concerning different scientific and engineering disciplines. Table 1 below is one such extraction from the University of Minnesota Library Web Site which provides a gateway to a large number of aerospace engineering e-resources to help the aerospace engineering community to access them just with the click of a mouse button. Many of the resources indicated below relate to Aerospace Engineering and covers broad areas such as development, design, construction, testing, and operation of aircraft and space vehicles. It also includes aeronautics, aircraft, aviation, astronautics, and space flight, Fransen [8]. It is pertinent to note here that many of the e-resources indicated in table 1 greatly facilitates the aerospace scientists and engineers for easy access to aerospace engineering e-journals for their scientific pursuits and also enabling them to keep in touch with global R&D.

Table 1
Selected Resources for Aerospace Engineering on the Internet

Sl. No.	Name of the Aerospace Resource	Description of its Contents
1.	**ABSTRACTS AND INDEXES** Academic or Scholarly Articles Subject Indexes	
	AIAA Papers	Includes full-text of the technical papers presented at the conferences of the American Institute of Aeronautics and Astronautics.
	Applied Science and Technology Abstracts	Indexes over 300 major English-language periodicals in a wide variety of technology subjects ranging from aeronautics, chemistry, and computers to physics, plastics, and transportation. Many recent citations include abstracts.
	Compendex	Provides extensive indexing of scholarly and technical periodicals, conference proceedings, and report literature in all engineering disciplines including applied physics, electronics, materials science, and related fields in science and management. Indexes nearly 3000 sources worldwide.
	IEEE Explore	Full-text access to the transactions, journals, magazines and conference proceedings of the Institute of Electrical and Electronics Engineers. Includes all current IEEE Standards.Remote access available for University of Minnesota – Twin Cities students, staff and faculty.
	Inspec	Provides comprehensive coverage of scholarly literature in the fields of physics and astrophysics, electrical engineering, electronics, computing and control, and information technology. Indexed are primarily journal articles and conference papers, with some books,technical reports, and dissertations. The database provides bibliographic citations plus abstracts.
	SAE International	Use this site to search for SAE technical

Sl. No.	Name of the Aerospace Resource	Description of its Contents
		papers, standards, conferences, and more. The Science & Engineering Library has the SAE technical papers available in print from 1948-2001 on level S, under call number TL1 .S552. SAE transactions (which contain select SAE technical papers) are also available from 1917-1965 on level S, call number TL1.S6. If you wish to access a technical paper published after 2001, please contact Interlibrary Loan
	Web of Science (ISI)	Indexes over 11,000 international journals in the sciences, social sciences, and arts and humanities. Titles of the print equivalent are: Arts and Humanities Citation Index, Science Citation Index, and Social Sciences Citation Index. Coverage runs from 1975 to the present. Basic truncation symbol is the asterisk(*).
2.	**CATALOGS & INDEXES TO GOVERNMENT PUBLICATIONS**	
	NACA Reports (National Advisory Committee for Aeronautics)	The bibliographic records in this file represent the document series produced by NASA's predecessor, the National Advisory Committee for Aeronautics (NACA), as well as various other aviation reports.
	NASA Technical Reports Server (NTRS)	Provides citation with abstracts mostly to technical reports relating to aerospace research. Covers NASA documents published since 1962, and NACA documents from 1915-1960. Many of the reports indexed can be found on microfiche in the Science and Engineering Library.
	NATO Research and Technology Organization (RTO)	Provides access to full-text documents produced by the RTO.
	National Technical Information Service (NTIS)	NTIS indexes government-sponsored U.S. and worldwide scientific, technical, engineering, and business-related publications with over 2.0 million bibliographic records since 1964. Contents include research reports, computer products, software, video and audio. See the NTIS Website for an overview of subject coverage and document delivery services.
3.	**DICTIONARIES**	
	Dictionary of Aeronautical English (http://umnlib.oit.umn.edu/F/QI7GE69442IBVSXLFCIB3TTLGRH1BI2SXSRAUYI4B67JH5TX6X-17400?func=find-c&=&ccl_term=sys%3D001263500&pds_handle=GUEST)	
	Dictionary of Technical Terms for Aerospace Use	An electronic version of a 1965 NASA dictionary. While the dictionary remains very useful for older and static terminology, many terms that are commonly used today, such as "space shuttle," are not to be found here.

Sl. No.	Name of the Aerospace Resource	Description of its Contents
	Illustrated Dictionary of Aviation	Covers all segments of aviation. Over 7,400 terms and 2,400 illustrations.
	NASA Thesaurus	An exhaustive compilation of aeronautical and astronautical terms, and their relationships to other terms. Particularly useful for identifying keywords to be used in comprehensive database searches of the aeronautical and astronautical literature.
	SAE Dictionary of Aerospace Engineering	An extensive technical dictionary for "aerospace engineers who design,test, and manufacture aerospace vehicles, components, and parts.
4.	**ENCYCLOPEDIAS** **Cambridge Encyclopedia of Space** (http://umnlib.oit.umn.edu/F/FSF8KPAMVMLKB568PXYVNCBMLFNE54994N8EB1P9P3YVR2H9EE-31052?func=find-c&=&ccl_term=sys%3D004155200&pds_handle=GUEST)	
5.	**HANDBOOKS AND MANUALS** **AIAA Aerospace Design Engineers Guide**	A condensed collection of "commonly used engineering reference data to assist the design engineer in creating and defining practical aerospace products." Published by the American Institute of Aeronautics and Astronautics.
	Civil Jet Aircraft Design	Introduces the procedures and practices of civil aircraft design involving conflicting requirements of performance, quality, safety, and environmental issues.
	Standard Handbook for Aeronautical and Astronautical Engineers	A comprehensive handbook for Aerospace engineers.
6.	**AEROSPACE STANDARDS** **Department of Defense Standards**	assistdocs.com (U.S. Department of Defense) provides access to Defense Standardization Program documents obtained from the official DoD repository, the ASSIST database
	NASA Technical Standards	Access point for standards developed and adopted by NASA programs.
7.	**TECHNICAL REPORTS** **Aerospace Professional Network**	Provides access to Aerospace related documents drawn from Institute of Engineering and Technology publications and conferences and other full text documents freely available on the Web.
8.	**INTERNET RESOURCES** **Electronic Books**	
	CRC Handbook of Mechanical Engineering (2nd Edition)	This Second Edition of the CRC Handbook of Mechanical Engineering covers every

Sl. No.	Name of the Aerospace Resource	Description of its Contents
		important aspect of the subject in one single volume. It provides a reference for the practicing engineer in industry, government, and academia, with relevant background and up-to-date information on the most important topics of modern mechanical engineering. These topics include modern manufacturing and design, robotics, computer engineering, environmental engineering, economics and project management, patent law, bioengineering, and communication and information systems. The final chapter and appendix provide information regarding physical properties and mathematical and computational methods.
	Electronic Texts	
	Advances in Dynamics and Control	Contains research papers contributed by international experts on a wide range of topics including rotorcraft dynamics, stabilization of unstable aircraft, spacecraft and satellite dynamics and control, missile auto-pilot and guidance design, hybrid system dynamics and control, intelligent control, neuro-fuzzy techniques, and structural and acoustic modelling.
	Harris' Shock and Vibration Handbook (5th Edition)	This handbook is a valuable guide to the solution of shock and vibration problems.
	MEMS and Microstructures in Aerospace Applications	Includes an overview of MEMS development, demonstrations of past and current examples of MEMS in space, and discussions of fabrication technologies; the effect of space environmental factors on MEMS devices; and micro technologies for space systems, instrumentation, communications, thermal control, guidance navigation and control, and propulsion.
9.	**GATEWAYS AND MEGASITES**	
	Aerospace Digital Library (URL: http://www.adl.gatech.edu/)	Direct access to the subject discipline of Aerospace Engineering. Site managed by Georgia Institute of Technology and Aerospace Engineering
	Recommended Web Sites for Aerospace and Aviation	An extensive collection of links to aerospace- and aviation-related websites. Maintained by Embry Riddle Aeronautical University's Hunt Library.
10.	**LISTSERVS AND DISCUSSION GROUPS**	
	SCAN-Selected Current Aerospace Notices	Updated weekly, SCAN is a free announcement service listing the latest aerospace-related scientific and technical information from around the world that has been entered into the NASA scientific and technical information knowledge base.
	STAR-Scientific and Technical	Updated biweekly, STAR highlights the

Sl. No.	Name of the Aerospace Resource	Description of its Contents
	Aerospace Reports	most recent additions to the NASA scientific and technical information knowledge base.
11.	**PERIODICALS AND NEWSPAPER SUBSCRIPTIONS**	
	NASA'S NewsRoom	Provides access to NASA press releases back to 1990, fact sheets, reports to Congress and the President, biographical information on NASA astronauts, and more. The entire site can also be searched by keyword.
	Today@NASA-News and Hot Topics from NASA	Announcements and summaries of current NASA missions and research projects.

Compiled from Original Source:
(htt://www.lib.umn.edu/subjects/rqs/66.html)
Note: for Individual URL's Refer to the Main Web Site Given Above

6. Use Patterns of Aerospace Engineering e-Journals amongst the Selected Aerospace Organizations in Bangalore.

The analysis of aerospace engineering e-journals usage amongst the 16 aerospace organizations is indicated below. Only the highest mean score, followed by the second highest mean score and the lowest mean scores are indicated. Rest of the details is available in Table 2.

The score ranges indicated in the questionnaire ranges from 0 – 4, indicating that the score of 0 means 'Never Use', 1 means 'Monthly', 2 means 'Fortnightly', 3 means 'Weekly' and finally 4 means 'Daily'.

Web of Science

Similar mean scores of 2.00 each is represented by the users of C-MMACS(CV=94.87), LRDE(CV=70.71), DARE(CV=79.06) and JNCASR(CV=0.00, 1 respondent only). This is followed by the Professors of IISc who generate a mean score of 1.62(CV=102.11). The lowest mean score of 0.38 is represented by the MIG pilots of ASTE accruing 238.04 as the CV value.

Informatics – J-Gate

Scientists from DARE and C-MMACS represent themselves with similar mean scores of 1.67 each and scoring respective CV values of 84.85 and 111.71 respectively. This is followed by the radar experts of LRDE who generate a mean score of 1.50(CV=141.42). The organization with the lowest mean score of 0.00 is occupied by the users of JNCASR(0.00, 1 respondent only).

European Space Bulletin (ESA)

The scientists of LRDE represent themselves with the highest mean score of 2.00 and accumulating a corresponding CV value of 141.42. This is followed by the scientists of DARE who come up with mean value of 1.67(CV=94.87). The lowest mean score of 0.00 is represented by JNCASR(CV=0.00, 1 respondent only).

International Journal of Satellite Communications and Networking

LRDE scientists occupy themselves with the highest mean score of 2.00 and scoring a CV value of 141.42. This is followed by the defense avionics experts DARE who show up with a score of 1.89(CV=89.55). The organizations with the lowest mean scores of 0.00 each are occupied by the scientists of C-MMACS(CV=0.00) and JNCASR(CV=0.00, 1 respondent only).

International Journal of Turbo and Jet Engines

The gas turbine experts of GTRE broadcast themselves with the highest mean value of 2.10 and scoring 67.34 as the CV value. This is followed by the DARE scientists who show up a mean score of 1.78 and accruing 87.95 as the CV value. The organizations with the lowest mean scores of 0.00 each is reflected by the scientists of C-MMACS(CV=0.00) and the fluid dynamists of JNCASR(0.00, 1 respondent only).

Journal of Aerospace Engineering (ASCE)

GTRE engineers show up themselves with the highest mean score of 2.14(CV=66.47). This is followed with near similar mean scores of 2.08 and 2.00 represented by the users of ADE(CV=72.24) and LRDE(CV=141.42). The organization with the lowest mean score of 0.00 is represented by the scientists of JNCASR(CV=0.00, 1 respondent only).

Progress in Aerospace Sciences

LRDE scientists show up themselves with the highest mean score of 2.50 and scoring a CV value of 84.85. This is followed by the engine experts of GTRE who get a mean score of 2.19 and CV=58.85. The lowest mean score of 0.00 is taken up by the scientists of JNCASR(CV=0.00, 1 respondent only).

Aerospace Science and Technology

LRDE projects itself with the highest mean score of 3.00 scoring 47.14 as the CV value. This is followed by the aeronautical engineers of ADE who represent themselves with a score of 2.00(CV=73.85). The lowest mean score of 0.00 is taken up by the scientists of JNCASR(CV=0.00, 1 respondent only).

IEEE Transactions on Electronic and Aerospace Systems

LRDE scientists depict themselves with the highest mean score of 3.00 and aggregating a CV value of 47.14. This is followed by the avionics experts of DARE who represent themselves with a score of 2.22 and scoring a CV value of 54.08. The lowest mean score of 0.00 is represented by the users of JNCASR(CV=0.00, 1 respondent only).

Online Journals: Aerospace

LRDE scientists represent themselves with the highest mean score of 2.00 and scoring 70.71 as the CV value. This followed by the aeronautical engineers of ADE who reflect themselves with a mean score of 1.83 and accruing 80.01 as the CV value. JNCASR represents itself with the lowest mean value of 0.00 and assimilating a CV value of 0.00(1 respondent only).

Journal of Failure Analysis and Prevention (ASM International)

The scientists of LRDE proliferate themselves with the highest mean score of 2.00 and accruing a CV value of 70.71. This is followed by the aeronautical engineers of ADE who represent themselves with a score of 1.33 representing a CV value of 107.66. The organization with the lowest mean score is attained by JNCASR scoring 0.00(1 respondent only) as the CV value.

Table 2
Frequency Of Access and Usage Of Aerospace Engineering e-Journals

SN	Organizations	Mean and CV	e-Aerospace Journals: Frequency of Access and Usage										
			Web of Science	Informatics J-Gate	European Space Bulletin (ESA)	International Journal of Satellite Communications and Networking	International Journal of Turbo and Jet Engines	Journal of Aerospace Engineering (ASCE)	Progress in Aerospace Sciences	Aerospace Science and Technology	IEEE transactions on Electronic and Aerospace Systems	Online Journals: Aerospace	Journal of Failure Analysis and Prevention (ASM International)
1	ADA	Mean	0.88	0.66	0.83	0.64	0.98	1.31	1.50	1.34	1.43	1.10	0.88

SN	Organizations	Mean and CV	e-Aerospace Journals: Frequency of Access and Usage										
			Web of Science	Informatics J-Gate	European Space Bulletin (ESA)	International Journal of Satellite Communications and Networking	International Journal of Turbo and Jet Engines	Journal of Aerospace Engineering (ASCE)	Progress in Aerospace Sciences	Aerospace Science and Technology	IEEE transactions on Electronic and Aerospace Systems	Online Journals: Aerospace	Journal of Failure Analysis and Prevention (ASM International)
		CV	139.82	152.77	139.78	167.91	134.09	106.22	95.31	103.81	98.92	109.61	150.75
2	AFTC	Mean	0.40	0.67	0.73	0.73	0.73	0.80	0.67	0.67	0.73	0.40	0.67
		CV	184.20	176.27	149.97	140.84	149.97	135.29	166.90	146.39	140.84	227.56	134.96
3	ADE	Mean	0.67	0.75	0.58	1.25	1.58	2.08	2.08	2.00	1.92	1.83	1.33
		CV	147.71	140.71	170.78	108.54	95.06	72.24	75.09	73.85	78.52	80.01	107.66
4	ASTE	Mean	0.38	0.38	0.48	0.38	0.59	0.55	0.24	0.38	0.66	0.45	0.24
		CV	238.04	276.63	196.67	248.25	154.72	171.85	325.74	238.04	174.39	184.59	306.35
5	CABS	Mean	0.50	0.29	0.14	0.21	0.64	1.00	0.50	1.21	0.64	0.57	0.36
		CV	130.09	164.08	254.20	270.17	130.96	87.71	130.09	86.54	144.48	202.63	235.73
6	CEMILAC	Mean	0.66	0.55	0.97	1.10	0.76	0.62	0.90	0.93	1.07	0.90	0.93
		CV	200.99	203.14	139.73	135.60	156.19	138.95	134.46	143.33	127.32	127.68	146.18
7	C-MMACS	Mean	2.00	1.67	0.17	0.00	0.00	0.67	1.33	1.17	1.00	1.17	0.33
		CV	94.87	111.71	244.95	0.00	0.00	181.66	122.47	137.32	167.33	126.17	244.95
8	DARE	Mean	2.00	1.67	1.67	1.89	1.78	1.89	1.56	1.89	2.22	0.56	0.33
		CV	79.06	84.85	94.87	89.55	87.95	81.35	97.02	97.06	54.08	182.48	150.00
9	LRDE	Mean	2.00	1.50	2.00	2.00	1.50	2.00	2.50	3.00	3.00	2.00	2.00
		CV	70.71	141.42	141.42	141.42	141.42	141.42	84.85	47.14	47.14	70.71	70.71
10	GTRE	Mean	1.14	0.81	1.05	1.00	2.10	2.14	2.19	1.76	1.19	1.24	1.24
		CV	154.77	168.56	143.11	154.92	67.34	66.47	58.85	75.95	108.29	113.95	105.01
11	HAL	Mean	0.90	0.58	0.68	0.57	0.80	1.06	1.03	1.04	0.89	0.81	0.80
		CV	139.15	168.93	153.86	169.89	149.51	121.79	126.54	126.45	140.59	145.51	142.23
12	IAM	Mean	0.61	0.36	0.48	0.33	0.52	0.39	0.39	0.52	0.42	0.24	0.48
		CV	188.76	236.35	193.76	193.65	233.35	200.07	178.82	188.71	186.63	207.03	200.51
13	ISRO-ISTRAC	Mean	0.82	0.50	1.18	1.64	1.32	0.86	1.36	1.14	1.14	1.18	0.55
		CV	139.29	237.05	103.26	95.32	108.27	120.10	114.38	119.29	116.16	132.22	176.46
14	IISc	Mean	1.62	0.71	0.62	0.35	0.94	1.56	1.62	1.94	1.24	1.06	0.59
		CV	102.11	176.22	154.45	250.35	127.99	90.99	93.83	84.07	121.32	125.08	178.14
15	JNCASR	Mean	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		CV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	NAL	Mean	1.29	0.99	0.72	0.62	0.85	1.20	1.41	1.51	1.21	1.18	0.89
		CV	106.06	129.32	144.05	159.26	136.19	103.99	89.60	90.53	109.84	106.88	141.33
Mean Scores of Usage of e-Aerospace Engineering Journals		Mean	1.01	0.72	0.73	0.67	0.90	1.12	1.20	1.25	1.08	0.95	0.78
		CV	132.41	160.02	150.54	166.17	137.69	114.14	111.16	110.44	121.57	129.23	151.37
P Values			0.000	0.006	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.048

Key: ADA=Aeronautical Development Agency, **AFTC**=Air Force Technical College, **ADE**=Aeronautical Development Establishment, **ASTE**=Aircraft Systems Testing Establishment, **CABS**=Centre for Airborne Systems, **CEMILAC**=Centre for Military Airworthiness and Certification, **C-MMACS**=Centre for Mathematical Modeling and Computer Simulation, **DARE**=Defense Avionics Research Establishment, **LRDE**=Electronics and Radar Development Establishment, **GTRE**=Gas Turbine Research Establishment, **HAL**=Hindustan Aeronautics Limited, **IAM**=Institute of Aerospace Medicine, **ISRO-ISTRAC**=Indian Space Research Organization, **IISc**=Indian Institute of Science, **JNCASR**=Jawaharlal Nehru Centre for Advanced Scientific Research, **NAL**=National Aerospace Laboratories.

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7. Conclusions

The main conclusions that authors would like to draw from the study are the following:

(a) ***Summary of Total Scores on 'Frequency of Access and Usage of Aerospace Engineering e-Journals':*** The summary of total mean scores obtained with regard to the above is as follows. The highest mean score of 1.25(CV=110.44) is obtained for the option 'Aerospace Science and Technology'. This is followed by a mean score of 1.20(CV=111.16) which is represented for 'Progress in Aerospace Sciences'. The third highest mean score of 1.12(CCV=114.14) is reflected for 'Journal of Aerospace Engineering'. This is followed by a mean score of 1.08(CV=121.57) which is represented for 'IEEE Transactions on Electronics and Aerospace Systems'. 'Web of Science' follows up with the next highest mean score of 1.01(CV=132.41). 'Online Journals: Aerospace' gets the next highest mean score of 0.95(CV=129.23). This is followed by the 'Journal of Turbo and Jet Engines' which gets the next highest mean score of 0.90(CV=137.69). 'The Journal of Failure Analysis and Prevention (ASM International)' comes up with the next highest mean score of 0.78(CV=151.37). This is followed by a mean score of 0.73(CV=150.54) which is represented by 'European Space Bulletin – ESA'. 'Informatics –Gate' represents itself with a mean score of 0.72(CV=160.02). Finally, the lowest mean score of 0.67(CV=166.17) is reflected for 'International Journal of Satellite Communications and Networking'.

(b) ***Analysis of Variance (ANOVA):*** was applied for testing the significant difference among the 16 mean scores attained from the scientists and engineers of the aerospace organizations for 'Frequency of Access and Usage of e-Aerospace Engineering Journals'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., 'Web of Science', 'Informatics J-Gate', European Space Bulletin – ESA', 'International Journal of Satellite Communications and Networking', 'International Journal of Turbo and Jet Engines', 'Journal of Aerospace Engineering – ASCE', 'Progress in Aerospace Sciences', Aerospace Science and Technology', 'IEEE transactions on Electronic and Aerospace Systems', 'Online Journals: Aerospace' and 'Journal of Failure Analysis and Prevention – ASM International'

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Title: Scholarly Electronic Communication amongst the Aerospace Engineering Community and the Impact of Electronic Journals: A Review Study

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Keywords: Information Processing in Science and Technology, Communication Behaviour of Scientists and Engineers, Engineers Information Seeking Behaviour, Scholarly Electronic Communication, The Aerospace Engineering Community, Impact of Electronic Journals.

Abstract: This review paper highlights the very special 'niche segment' to which the aerospace scientists and engineers belonging to different countries right across the globe occupy. Highlighting Aviation as one of the most significant technological marvels of our times, the paper discusses in detail the various significant aspects related to what aerospace engineering is all about and how the electronic media has come in a big way to support scholarly communication within this 'niche' aerospace engineering community. The paper also reviews the impact of Internet, the availability of high-speed networks which has enabled these scientists and engineers have access to electronic journals right at their desktops and also keep track of the global R&D happenings in their respective field of specialization. Various studies conducted (as indicated in this paper) illustrate how 'electronic journals' are highly important to the aerospace scientists and engineers. Important studies in this connection have also proved that scientists are willing to pay a high price in their time to spend many hours reading electronic scientific literature. Many relevant studies also have revealed that the information that a scientist or engineer gets from refereed journals has greatly resulted in their improved performance. The review paper also touches upon key aspects like (a) Distinguishing Engineers from Scientists, (b) Their differences in knowledge diffusion, (c) Their Communication Behaviours, (d) Their Information Seeking Behaviour, (e) The Aerospace Engineering Community in particular and the (g) the Importance of Scientific Communication for advances in Aerospace Engineering and the need for Electronic Information Resources.